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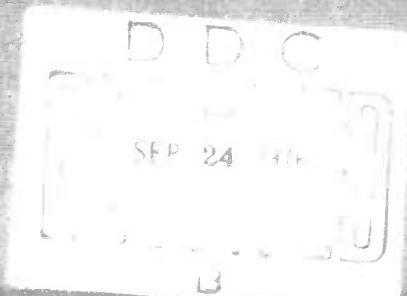
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A Digest of Soviet Science & Technology

CONTENTS

July 1972

Automatic IR Survey Equipment
Threat-Warning Radar	.....
Automatic Detection of Short-Duration Radar Signals	.....
Control and the Radar in the Anti-Aircraft Environment	.....
Formation of a Control Plane in the Radar Environment	.....
Geometrical Problems in Radar Distance Measurements	.....
Induction Storage in the Far-Field Region	.....
Optical Study of Light Scattering	.....
Growing Angle-Corona Composites	.....
High-Temperature Polymer Coating	.....
Fuel Cell Electrodes	.....
Characteristics of Fuel Cell Power Sources	.....
A New Aircraft Structural and Propulsion System	.....
Space Technology for 1972-1980	.....
New Airborne Marine Geophysical Data Systems	.....
New Electrochemical Power Systems	.....
Continuous Scattering Meter for Studying Particle Scattering Cross-Section	.....
Activities and Plans of the Marine Hydrophysical Institute	.....
High-Speed Shock-Wave Test Facility	.....
Building of the Soviet Navy	.....
New Projects Configuration	.....
Photographic Recording Media	.....
Series of Gas and Plasma Laser Developments	.....
Using Earth Satellites to Power Satellite Solar Batteries	.....
Review on Underwater Explosion	.....
Effect of Injection or Suction on Wall Turbulent Flow	.....
Prize-Winning Work on Turbulence and Heat Exchange
Recent Publications



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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This is a collection of brief abstracts on miscellaneous topics from the current Soviet technical literature. The intent is to supply a quick look at items of possible interest, including topics not necessarily named in the DARPA interest profile, as a supplement to our reportage on specified topics. It is intended to publish this collection on a monthly basis, to continue to provide prompt coverage of numerous aspects of Soviet R&D.		

INTRODUCTION

This is a collection of brief abstracts on miscellaneous topics from the current Soviet technical literature. The intent is to supply a quick look at items of possible interest, including topics not necessarily named in the DARPA interest profile, as a supplement to our reportage on specified topics.

It is intended to publish this collection on a monthly basis, to continue to provide prompt coverage of numerous aspects of Soviet R&D. As an added feature, all recently acquired books will be listed as they are received. A list of source abbreviations is appended.

For further information the reader is invited to call Stuart Hibben or Lee Boylan at Informatics on (301) 770-3000.

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Airborne IR Survey Equipment (abstract)

The Physics Department of the Leningrad Electrotechnical Institute, in conjunction with the Leningrad Branch of the State Oceanographic Institute, has developed the MIR-3 airborne IR radiometer. This improved 20-kg unit is replacing an earlier unit which weighed 200 kg and which had been installed aboard an IL-14 "flying laboratory" apparently belonging to the Laboratory for Aerial [Survey] Methods.

A six-hour flight to map the surface temperature of Lake Onega from an altitude of 300 m is described briefly. Flights with the new equipment have been made over Lake Ladoga, the Black Sea, and the Sea of Azov. Plans call for future flights over the Baltic Sea. It is mentioned that Laboratory personnel spend as much as 300 hours per year per man on these surveys. [Sapunova, G. Laboratory over a lake. Leningradskaya pravda, 13 Aug. 1976, p. 4, cols. 1-4]

Ground-Mapping Radar (abstract)

A side-look mapping radar identified as Toros has been used by the Soviets several years, mainly in polar regions for selecting sea lanes through ice regions and identifying terrain under snow or ice cover. Descriptions of experiments with Toros have appeared since 1969, including its general operating mode, imaging method etc., although without specifications on the radar parameters.

A news article now indicates that the Toros system installed in an AN-24 aircraft has been adapted for more general ground mapping, including identifying types of geologic formation, forest and crop vegetation etc. It is not specified whether this is an advanced version of Toros, but the article does make rather extravagant claims for relief resolution, stating that it can resolve "any height projection above two centimeters." The article goes on to imply that this technique can be refined to penetrate the porous earth crustal layer to depths of 30 meters, allowing mapping of the denser base layer. No other radar specifications are given. [Druyanov, V. Radar feels the earth. Sotsialisticheskaya industriya, 17 July 1976, p. 4.]

Adaptive Reception of Broad-Band Radio Signals (abstract)

An adaptive radio receiver of broad-band signals is described and its possible gain is evaluated when operating within a large radio communication system. Information loss in the adaptive receiver is shown to decrease when the number (i) of narrowband adaptive subsystems (radio stations) within the larger system is increased. Information loss is due to a number ($n-i$) of nonadaptive narrowband stations. The minimum possible decrease in information loss, i.e., minimum gain, of the receiver at $i=n$ is found to be $r_{0,n} = 0.37r_{n,0}$. The probability p that at least a $1/n$ portion of a given frequency band will be made available by adaptation of one narrowband emitter is estimated independently

to be $(1-2^{-n})$. [Kondaurov, M. T. and B. I. Kuz'min. Gain in adaptive reception of broad-band signals in radio communication. IVUZ Radioelektr, no. 7, 1976, 134-136].

Optical Antenna Resolution vs. Atmospheric Turbulence (verbatim)

The resolution capabilities of receiving optical systems are evaluated. It is shown that spatial coherence of field fluctuations must be taken into account in determining the effective width of the antenna radiation pattern, since the characteristics of receiving antennas, and particularly those of radiation patterns, are random functions. Formulas are derived for the coefficient of spatial coherence, for possible use in evaluation of resolution of optical systems. [Lobkova, L. M. Evaluating the resolution of optical antennas as a function of atmospheric turbulence. IN: Priborostroyeniye. Respublikanskiy mezhvedomstvennyy nauchno-tekhnicheskiy sbornik, no. 20, 1976, 47-50. (RZh Radiot, 6/76, #6#100)].

Formation of a Beam-Plasma Discharge in the Upper Atmosphere (abstract)

The problem is studied of the formation of a beam-plasma discharge in the upper atmosphere, by means of an electron beam injected from a moving source. The conditions for such a discharge in the absence of a magnetic field were experimentally tested during lateral movement of an electron beam ($I_0 = 50-150$ ma, $U_0 = 1-5$ kv) relative to a fixed gas (argon, helium) at pressures of $10^{-3}-10^{-2}$ torr.

Results showed that at these pressures, an electron beam of medium power (200-800 w) moving laterally in a fixed gas could produce a discharge at relative velocities up to 4-7 km/sec, which is the characteristic velocity range for spacecraft in the upper atmosphere. The critical velocity of the electron beam relative to the gas for forming a discharge decreases with increase in gas pressure, but can be significantly increased by increasing beam intensity. The relationship between the critical velocity and beam-plasma discharge can be explained in terms of plasma characteristics: ion mobility, electron temperature, plasma concentration and its spatial gradient. Examples of plasma discharges obtained in the test chamber are included. [Vlasenko, S. I., V. P. Popovich, and I. F. Kharchenko. Formation of a beam-plasma discharge during injection of an electron beam in a gas flow. Fizika plazmy, no. 2, 1976, 272-276].

Geomagnetic Pulsations vs. Ionospheric Disturbances (abstract)

Amplitude damping of recently recorded Pc 1 geomagnetic pulsations propagating through the ionospheric waveguide is analyzed, to determine purely ionospheric effects on Pc 1 propagation. Diurnal variations of Pc 1 amplitude attenuation were observed in the conjugate Sogra-Kerguelen points and at the Borok Geophysical Observatory in the Northern USSR. The amplitude modulation characteristic δ_n of Pc 1

pulsations observed at the conjugate points is shown to be a function of ionospheric propagation conditions in the Northern and Southern Hemispheres only, thus excluding magnetospheric effects.

Using the data of the two observatories (Sogra and Borok) located in the same hemisphere, the authors introduce the characteristic χ_n , which describes conditions of ionospheric propagation in the Northern Hemisphere alone. Fluctuations with 5 to 50 min. periods were detected in the δ and χ spectral density curves, although the shape of the two curves differed. Ionospheric processes involved in modulation of Pc 1 amplitude are interpreted as the effect of disturbances caused by gravitational waves in the F-layer. [Montveyeva, E. T. and A. L. Kalisher. Modulation of type Pc 1 pulsation intensity by disturbances in the ionospheric waveguide. GiA, no. 3, 1976, 531-534].

Induction Storage Device For a Fusion Reactor (verbatim)

The Dvin θ -pinch device with liner was designed to solve several physical and engineering problems in development of fusion reactors. Its power source is based on a 20 Mj induction store with 2×10^{11} W pulse power. The storage consists of a single-layer 160-turn self-cooled solenoid. The solenoid is enclosed by a matching sectional transformer. Solenoid field intensity is 50 kOe. Currents to 50 kA are attained in a few seconds. A commutation system provides for energy coupling to the load in about 10^{-4} sec. The strength of the storage parts is also analyzed. [Glukhikh, V. A. Zheltov, A. V. Ivlev, et al. Induction storage device for the Dvin reactor. IN: Doklady Vsesoyznogo soveshchaniya po inzhenernym problemam upravlyayemago termoyadernogo sinteza, Leningrad, V. I., 1975, 312-318. (RZhF, 6/76, #6G209)].

Optical Study of Lightning (abstract)

The development mechanism and physical characteristics of lightning discharges were studied from photographs recorded during 1971-1972 in a field laboratory in the Malyy Kavkaz mountains. An automatic Boyce camera with time scanning was used to record day and night-time discharges.

Analysis of the photographs shows that both cloud-to-earth and intercloud discharges are multipulsed (1 to 10 pulses) with 7 to 75 msec periodicity. The first pulse in a cloud-to-earth discharge is typically branched, and more intense than the following pulses. Both stepwise and arrow-shaped propagation modes of the first pulse were observed. The first pulse with an arrow-shaped leader propagates at a speed decreasing from 1.4×10^8 cm/sec with approach to the earth. In the intercloud discharge, the first pulse propagates stepwise at 1.5×10^7 cm/sec maximum speed of the leader. [Alizade, A. A., F. L. Khydyrov and R. K. Musayev. Data on an optical study of lightning. IAN AzSSR, no. 6, 1975, 85-91].

Growing Single-Crystal Composites (abstract)

Leucosapphire single crystals, reinforced with a tungsten fiber matrix in the growth process, have been prepared for possible use as a heat and chemically resistant, high-strength structural composite. Reinforcement is shown to increase flexure yield point and ultimate flexure strength of leucosapphire specimens by 1.5 to 2 times at 1700 C. In addition, the tungsten fiber reinforcement prevents crack propagation during specimen deformation. Dislocation density increases only in the vicinity of fiber outcrop points on the polished crystal surface.

In a broad sense, this method of using reinforced seeds makes it possible to obtain single crystals with a programmed dislocation structure. This conclusion implies the possibility of obtaining single crystal materials with predetermined mechanical and physical characteristics. [Bagdasarov, Kh. S., V. G. Govorkov, M. V. Klassen-Neklyudova and V. P. Konstantinova. Possibility of growing reinforced single crystals. DAN SSSR, v. 228, no. 4, 1976, 840-841].

High-Temperature Polymer Coating (verbatim)

The effect was studied of diethylaminomethyltriethoxysilane (ADE-3) additives on the thermal stability as well as physical mechanical and dielectric characteristics of poly(methylsiloxane) (PMS) and poly(methylphenylsiloxane) (PMPS) with 80% alumina or phlogopite. Tests were done at temperatures up to 1000 C. DTA data indicate that oxidation and structural modification occur at 70 to 100° higher temperatures, when the heating rate is increased from 2 to 15°/min. Additions of 0.5% ADE-3 to PMS and PMPS decrease their weight loss by 3 to 4% and 6%, respectively, and their water absorption from 18 to 9%. The same additions increase polymer adhesion from 365 to 470 G/cm, the number of their 20-to-900° thermal cycles from 2 to 30, and their electrical strength from 13.2 to 18.1 kv/mm. Coatings of the modified materials will withstand a prolonged heating at 800° in air. Volume resistivity of the annealed material is nearly one order of magnitude higher than that of the unmodified material. [Vladykina, M. B., V. S. Osipchik, M. S. Akutin, L. Ye. Alekseyeva and P. P. Oleynikov. High temperature properties of filled polyorganosiloxanes. IN: Moskovskiy khimiko-tekhnologicheskii institut imeni Mendeleyeva. Trudy, no. 86, 1975, 78-80. (RZhKh 19T, 7/76, #7T158)].

Fuel Cell Electrodes (verbatim)

Methods of preparation of nickel and nickel-platinum porous electrodes, and research data on their performance in electrochemical oxidation of hydrazine and methanol, are examined. Chemically or electrochemically prepared Ni powder, compacted under 700 to 1000 kg/cm² and sintered in a hydrogen atmosphere, is recommended for anodes of hydrazine fuel cells. Only Ni-Pt anodes are suitable for methanol fuel cells. [Constantinescu, D. and I. Atanasiu. Liquid fuel cells. 2. Fuel cell electrode. Nickel and nickel-platinum porous electrodes. Rev. chim. (Romania), v. 26, no. 7, 1975, 567-572. (RZhKh 19L, 5/76, #5L297)].

Optimization of Fuel Cell Parameters (verbatim)

The effects were studied of the electrolyte temperature, KOH concentration and oxygen overpressure in the ranges of 45 to 65° C, 4 to 7 N and 400 to 500 torr, respectively, on polarization of biporous silver electrodes used as cathodes in alkaline fuel cells. At 10, 30, 50, 70 and 90 ma/cm² current densities, the respective optimum temperatures and concentrations of the electrolyte were 51.5° C and 4.96 N, 61.5° C and 5.63 N, 64.1° C and 5.8 N, 78.9° C and 5.75 N, 94.8° C and 5.68 N. [Mavrodin-Tarabic, M., J. Onaca, and I. Solacolu. Optimization of working parameters of gas-diffusion silver electrode for oxygen reduction. Rev. chim. (Romania), v. 26, no. 7, 1975, 555-559. (RZhKh 19L, 5/76, #5L298)].

A Superhard Structural and Tool Material (abstract)

X-ray studies are reported of the phase composition and structural properties of superhard carbonado-type structural and tool material specimens with weights up to 20 carats. Experiments were done with prefinished specimens of 8-10 mm diameter, height 8 mm and obtained at 1200 C and pressure of 90 kbar.

X-ray data on polycrystalline carbonado powder specimens showed that along with the presence of diamond, the test specimen also contained other chemical compounds including carbides of chromium, nickel and boron. Based on the broadening of x-ray lines in diamond, microstresses were detected during the formation process of these carbonado-type materials. The value of microstresses was approximately 400 kg/mm², and the dimensions of diamond elements formed in the process were of the order of 10⁻⁴ cm. The density of dislocations was measured in the range of 6 to 12 x 10¹¹ cm⁻². [Malikova, Zh. G. Investigating structural-mechanical properties of a carbonado-type superhard tool and structural material. FizKhOM, no. 3, 1976, 94-97].

Optical Oceanography for 1972-74 Reviewed (Summary)

Soviet (111) and non-Soviet (78) works on optical oceanography, published between 1972-1974, provide the basis for this extensive review. The review covers the optical properties of sea water, light fields in the ocean, optical methods for studying the ocean, and remote sensing of the ocean. Frequent references are made to research and equipment involved in the 5th and 10th cruises of the R/V Dmitriy Mendeleev. In general, substantial attention is given to instrumentation and in particular to laser-based measurement technology. The authors consider the technology associated with the Deep Ocean Optical Measurement Program a significant achievement in optical oceanography, and they point to Soviet hydrooptical research performed from the Chernomor underwater laboratory program as a noteworthy new research approach.

Remote sensing from air- and space-borne platforms is looked at briefly from the microwave standpoint. The proposed use of a pulsed laser radar to determine wave height and length (Zakharov, V. M., et al. *Trudy TsAO*, no. 105, 1973) is also discussed. A potential method for determining chlorophyll content of ocean water from a spacecraft is mentioned as being of interest for the indirect determination of plankton content; the possible application of lasers to chlorophyll determination is suggested. [Kopelevich, O. V., Yu. Ye. Ochakovskiy, and K. S. Shifrin. Ocean optics. *Itogi nauki i tekhniki. Okeanologiya*, no. 3, 1975, 113-150].

New Shipboard Marine Geophysical Data System (abstract)

Between 1970 and 1975, the Institute of Oceanology's Southern Branch developed, manufactured, and put in operation 13 units of the "GRAD" shipboard automatic marine geophysical data acquisition system. The GRAD system can handle outputs from 64 to 120 separate sensors of the following types: seismometric (24-48), magnetometric (5), electric field measurement (4), gravimetric (10), radiometric (10), thermometric (10-20), and radiogeodetic and hydrographic (10). The system provides for data transmission to shore-based computers (Minsk-32 or ES-series), mag tape and punched data storage aboard ship, and simultaneous plotting of geophysical parameters over bathymetry and sub-bottom profiling on a FAK-P precision graphic recorder.

GRAD has eight basic operating modes in which the following parameter combination are measured: 1) sub-bottom profiling, magnetic field, gravity, hydrography, and navigational and radiogeodetic elements; 2) sub-bottom profiling and radiogeodetic measurements; 3) electric field, gravity, and radiogeodetic measurements; 4) electric field and radiogeodetic measurements; 5) magnetic field, gravity, and radiogeodetic measurements; 6) magnetic field and radiogeodetic measurements; 7) gravity and radiogeodetic measurements; and 8) radiogeodetic measurements. The entire system (less sensors) weighs 800 kg and its mean time before failure is given as 100 hrs or more.

GRAD has been installed on vessels displacing 400 to 7000 tons. The system is manned in three-man shifts instead of the 10-12 men used with earlier systems. An annual savings of 200,000 to 350,000 rubles per ship is cited for the use of the GRAD system [Kogan, L. I., et al. GRAD automated shipboard data acquisition systems for marine geophysical research. *Okeanologiya*, no. 3, 1976, 531-537].

New Electrochemical Power Systems (verbatim)

Three possible cycle systems of hydrogen energy utilization are examined: the so-called ecoenergetic general cycle; decomposition of hydrogen-containing products, including natural gas; and direct oxidation of hydrogen-containing products. Cost analysis indicates definite advantages of the electrochemical power generation system over the other power sources. It is anticipated that in the next 20 to 30 years development of the ecoenergetic systems using hydrogen energy will attain the required engineering level at substantial cost savings. Their realization will contribute to solution

of a wide range of national economic problems [Lidorenko, N. S., and G. F. Muchnik. Electrochemistry and new systems of electrical energy production. IN: XI Mendeleyevskiy s'yezd po obshchey i prikladnoy khimii. Sbornik no. 3. Moskva. Izd-vo Nauka, 1975, 327-330. (RZhKh 19L, 5/76, #5L293)].

Small-Angle Scatterance Meter for Studying Vertical Scatterance Stratification (abstract)

During the 10th cruise of R/V Dmitriy Mendeleyev, an improved model of the "Poseydon" scatterance meter was used to study the vertical stratification of scattering properties at 16 fixed angles from 38' to 9° and at depths to 140 m. The "Poseydon's" light source is an LG-55 He-Ne laser. Data output is to a KSP-4 plotter and to a digital printer or measuring system, the latter being useful in determining volume scattering function. The relative measurement error determined from laboratory tests is 6%, i. e., the accuracy with which changes in the scattering coefficient can be measured.

The existence of previously observed non-stable layers of reduced transparency (previously termed "run-away" scattering layers) was confirmed. These layers are observed as the instrument descends through them, but disappear when the instrument ascends through them. The present authors prefer to term these layers as "labile" scattering layers to avoid the connotation of mobile organisms forming the layers. They note that the layer coincides with layers of maximum density gradient and was observed within an easterly subsurface current. A tentative explanation of the phenomenon is given, and its further study is recommended. [Kopelevich, O. V., et al. Study of the vertical stratification of scattering layers, using a small angle scatterance meter. IN: Gidrofizicheskiye i opticheskiye issledovaniya v Indiyском okeane. Nauka, 1975, 54-60].

Activities and Plans of the Marine Hydrophysical Institute (abstract)

According to B. Nelepo, Director of the Marine Hydrophysical Institute (Ukrainian Academy of Sciences), the Institute's tenth five-year plan will stress the development of theory on the formation of hydrophysical fields and a thermohydrodynamic model of the ocean. On the engineering side, the Institute will continue its efforts in the broad-scale automation of oceanographic research, the development of methods and equipment for the systemic study of hydrophysical processes, and basic research in satellite oceanography.

The Institute's R/V Akademik Vernadskiy has just returned from a joint Soviet-French program in the Gulf of Lions. Under a technical assistance program, the Marine Hydrophysical Institute will be helping the Republic of Guinea in establishing a scientific-research center in Conakry, which will conduct research in oceanography and solar physics. Studies of the effects of tropical climate on structural materials and equipment components will also be performed. The center's mission will be to study and exploit the resources of the Guinean shelf and the training of Guinean scientists and engineers. [Nelepo, B. Floating laboratories. Pravda Ukrainy, 31 Aug. 76, p. 2, cols. 3-8].

Hydrophone Sensitivity Test Patented (abstract)

A Soviet patent has been issued for a method of measuring hydrophone sensitivity, based on the relationship of the measured hydrophone parameter to sound pressure generated by an acoustic field in a small-volume measurement chamber. Sound-pressure magnitude is found through compensation of the pressure effect on a precalibrated compensation converter, by applying an external compensating excitation to the converter; the magnitude of this excitation is measured.

To simplify the measurement process and facilitate its automation, the magnitude of the external excitation is held constant, while compensation is achieved by varying the acoustic field in the measurement chamber [Dmitrevskiy, N. N., et al. Method of measuring hydrophone sensitivity. Otkr izob, no. 17, 1976, Author Certificate 513535, p. 197].

Buildup of the Soviet Navy (abstract)

A lengthy monograph on naval power has recently appeared by the late Admiral Sergei Gorshkov. The bulk of the four-chapter book reviews naval history, and includes lengthy digressions into naval philosophy and strategy. The first, second and fourth chapters are of this type, tracing Russian and Western naval history up through World War II. Chapter 3, which appears to have the most pertinent information, reviews the general development of naval power following WWII. The first two sections of the chapter are devoted to US and NATO naval forces; the third section discusses the Soviet postwar buildup.

Gorshkov considers the postwar Soviet Navy in two periods. The first dates from 1945 to the early 50's, when the existing navy was being built up but without any gross change in strategy or type of armament; that is, the Soviet fleet was still serving primarily as a protective shield for Soviet home waters. Starting with 1954, when nuclear weaponry including H-bombs were tactically deployed by the Russians, their navy entered into its new and aggressive program for becoming a major world sea power. Here the usual lip service is paid to the foresight of Party leaders, solidarity of industrial forces behind the new program, etc., but Gorshkov repeatedly returns to atomic power, both in propulsion and weaponry, as being the new equalizing factor which has enabled the Soviets to close the gap with Western navies.

Gorshkov itemizes the specific factors which helped transform the Soviet fleet as follows:

- o building of a nuclear submarine fleet
- o introduction of surface and underwater nuclear missiles
- o building of a long-range naval air arm and its support vessels
- o new techniques in ASW
- o new electronic warfare methods
- o automatization of weapon control
- o advanced research in and application of computer technology

Advanced radar techniques are also singled out here as a major factor, but without further amplification.

In the fourth and final section of this chapter, Gorshkov reviews the latest trends in naval warfare generally, without specific reference to Soviet efforts. The discussion includes advanced submarines with multiple-warhead underwater missiles; this is mostly a rundown of US achievements.

In future developments Gorshkov foresees a radical change within 20 years in surface ship design, in view of present advances in air cushion vehicles and hydrofoils. Nevertheless he sees naval warfare as being gradually taken over by aircraft and submarines, with correspondingly less emphasis on surface vessels. [Morskaya moshch gosudarstva (Naval power of the state). S. G. Gorshkov. Moskva, Voenizdat, 1976, 464 p.]

New Projectile Configuration (abstract)

Tests have been recently reported on a radical departure from the conventional body-of-revolution design common to nose cones or projectiles. Based on earlier research on the aerodynamics of star-shaped cross section and other multifaceted bodies, the Institute of Theoretical and Applied Mechanics has developed a tapered cruciform configuration for a body with reduced drag at speeds of Mach 4 and 6. Tests in the Institute's T-313 hypersonic wind tunnel compared drag of the faceted body with that of an ellipsoid of rotation having equivalent length and volume. The faceted body model was 165 mm long, and the leading edges of the cruciform was 0.2 mm thick.

The tests showed that at $M = 4$, the faceted model had 1.1 times less drag than its ellipsoid equivalent, while at $M = 6$, the drag was 1.35 times less. The feeling is expressed that further improvement in drag reduction can be achieved by increasing the areas of one of the facets. [Vedernikov, Yu. A. Drag reduction for a plane faceted body. Akademiya nauk SSSR. Sibirskoye otdeleniye. Izvestiya. Seriya tekhnicheskikh nauk, no. 8(2), 1976, 41-46].

Holographic Recording Media (abstract)

The Scientific Committee on Holography, which falls under the Academy's Department of General Physics and Astronomy, has published a collection of recent studies on holographic recording media and techniques. The articles are considered in two general categories, the first being review papers of standard high-resolution silver halide techniques as well as some non-silver methods; remainder treats more original results in developing new holographic media, both in silver and non-silver types. The work is a general update of a similar effort published by the same group in 1973.

This collection is offered as an overview of the state-of-the-art, but is not intended to be comprehensive. The patent literature, for example, is specifically excluded, as well as details on technology of preparing high quality holographic materials. Several Soviet developments are touted here, including a type FPG-2 high sensitivity film for panoramic volume holographic imaging, and the PE-1 "transparent" films, which are listed as producing the first pulsed color 3-D holograms. The PE and LOI "transparent" films are cited as developments not yet achieved outside the USSR. Most of the articles include experimental results, many of which give performance comparisons with their foreign counterparts. [_____. Registriruyushchiy sredy dlya golografii (Recording media for holography.) Leningrad, Nauka, 1975, 175 p. (RBL, 5-6/76, no. 917)].

Review of Gas and Plasma Laser Developments (abstract)

A recent publication of the Academy's Lebedev Institute is devoted to the present status and prospects for future development of high-power gas and plasma lasers. The range covered is from submillimeter to vacuum ultraviolet, but with main emphasis on molecular lasers based on vibrational-rotational transitions, lasing in the near IR range. Copious reference is made to both Soviet and U.S. sources, from material current through the early 1970's.

An introductory article briefly sums up the status of molecular gas types (electric, chemical, gasdynamic), and plasma types based on electron transitions. Electric types, which show the greatest promise to date, are subdivided into categories of c-w, pulsed, pre-ionized and TEA types, for which the limiting factors on power and efficiency are mentioned; heat loss is a general problem here.

In chemical lasers the basic problem cited is that of initiating the chain reactions which provide pumping. Present emphasis is on lasing in CO, CO₂ and HF reactions; powers up to 10⁵ watts for the HF laser are seen possible. Improved pumping through recombination is also suggested as worth examining for chemical lasers.

Gasdynamic lasers are treated as chemical GDL, electrical discharge (EDL) and more recently the high temperature EDL type at working temperatures over 3500°. The c-w level of 10⁵ watts achieved for GDL's appears to be the limit for this type of laser.

In going to the far IR range, power drops off drastically, mainly owing to increased relaxation rates of the excited levels. Possible paths to explore here would be a transverse electric-discharge water vapor type with fast pumping, as well as variants of the GDL and chemical laser.

Lasers based on plasma as the working material have been notably less successful in power attainment, but still are seen as having worthwhile potential. They are discussed here similarly to the molecular types, i. e. as pulsed electric plasma, moving plasma or plasmadynamic, and plasmochemical lasers.

Each of the above listed laser types is analyzed in detail by other authors in the remainder of this collection of articles. [Shelepin, L. A. Trends in laser development. IN: Trudy FIAN, no. 83, 1975, 3-12],

Using Earth's Shine to Boost Satellite Solar Batteries (abstract)

Increasing a satellite's solar battery power has been reported by adding sensors to pick up reflected Earth radiation as well as direct solar radiation. Calculations show that a power gain of 10 to 30% could be realized with such double-faced solar panels depending on panel geometry and attitude.

This was confirmed by comparative power tests on a Cosmos satellite, which showed that the double-sided cell developed as much as 34% more power per orbit than the normal single cell. The test also showed that with the earth-shine conversion, power is generated over a greater percentage of the orbit. [Bordina, N. M., N. A. Borisova, G. S. Daletskiy, et al. Using radiation reflected from the Earth for increasing power in a solar battery. Kosmicheskiye issledovaniya, no. 2, 1976, 293-299].

Review on Underwater Explosion (verbatim)

A review is presented of research data on underwater explosion, published in recent years. Important investigations are briefly described and their results are given. The review consists of three chapters. Chapter One deals with the problems of explosive detonation, the dynamic compressibility of water, equations of state of water, and explosion products. The action of an explosion in an unconfined liquid, and new phenomena of a laser microexplosion in water, are treated in Chapter Two. The third chapter outlines two-dimensional problems of explosion theory in a small reservoir. Results are described of studies on shock wave interaction with the free surface and bottom of the reservoir, movement of gas bubbles and development of surface effects. [Korobeynikov, V. P., and B. D. Khristoforov. Underwater explosion. IN: Itogi nauki i tekhniki. Gidromekhanika, no. 9, 1976].

Effect of Injection or Suction on Wall Turbulent Flow (abstract)

The effects of fluid injection or suction through a porous plate are evaluated, with respect to the turbulent boundary-layer skin friction at the plate. The boundary layer is visualized as separated by the maximum velocity line into a near-wall and a free jet region.

Approximate analytical expressions are derived for the turbulent friction coefficient ψ versus the parameter t of injection ($t > 0$) or suction ($t < 0$), and the constant ratio δ_L/δ of laminar sublayer thickness to that of the near-wall region. With the derived expressions, $\psi(t)$ functions at different δ_L/δ values were evaluated for the cases of incompressible and compressible semi-bounded turbulent jets propagating over a porous plate. The transverse component of flow velocity is assumed to be negligible. In both cases, theoretical plots of $\psi(t)$ show that ψ decreases, when injection ($t > 0$) is increased and ψ increases, when suction ($t < 0$) is decreased. The

same method of approximate evaluation can be applied to a gas jet flowing over a porous conical surface. [Girol', A. P. Effects of fluid injection in and suction from a turbulent semi-bounded jet on skin friction of a porous plate. IN: Sb. Gidromekhanika, no. 31, 1975, 17-21].

Prize-Winning Work on Turbulence and Heat Exchange (verbatim)

The Academy of Sciences announces a State prize award to S. Kutateladze for his two recently issued monographs on wall turbulence and heat exchange theory. The heat exchange monograph covers a wide range of topics and attempts to systematically summarize current achievements in this field.

The former work investigates factors governing flow in a wall boundary layer. The treatment includes methods for calculating a boundary layer, based on the so-called limit laws of friction and heat exchange. It includes pertinent test data on generation of turbulent energy near the wall, on the effects of polymer additives on velocity profile, and other topics. [_____. Khronika i informatsiya. VAN, no. 5, 1976, 121].

Recent Publications

Abakumov, B. M. et al. Registratsiya opticheskoy informatsii na tonkiye magnitnyye pl nki (Recording optical information on thin magnetic film). Moskva, Atomizdat, 1976, 119 p. (LC)

Abrikosov, N. Kh. et al. Poluprovodnikovye khal'kogenidy i splavy na ikh osnove (Semiconducting chalcogenides and alloys based on them). Moskva, Nauka, 1975, 219 p. (LC)

Baum, V. A., ed. Solnechnyye energeticheskiye ustanovki (Solar power stations). Energeticheskiy institut imeni Krzhizhanovskogo. Moskva, Sbornik, no. 24, 1974 (published in 1975), 308 p. (KL, 12/76, #9828).

Belotserkovskiy, G. B. Osnovy radiolokatsii i radiolokatsionnyye ustroystva. (Principles of radar and radar systems). Moscow, Sovetskoye radio, 1975, 336 pp. (RBL, 7-8/76, no. 1605)

Buzanova, L. K., et al. Poluprovodnikovyye fotopriyemniki (Semiconductor photodetectors). Moscow, Energiya, 1976, 64 pp. (RBL, 7-8/76, no. 1635)

Gitel'zon, I. I., ed. Problemy sozdaniya biologotekhnicheskikh sistem zhizneobespecheniya cheloveka. Sbornik statey (Problems in the development of biotechnical life support systems). Institut fiziki imeni Kirenskogo, Akademiya nauk SSSR, Sibirskoye otdeleniye. Novosibirsk, Izd-vo Nauka, 1975, 271 p. (KL, 12/76, #9744)

Il'ichev, V. D., B. D. Vasil'yev, R. D. Zhantiyev, et al. Bioakustike (Bioacoustics) (Text for biology majors). Moskva, Izd-vo Vysshaya shkola, 1975, 256 p. (KL, 12/76, #9733)

Krasov, N. V. Podvodno-tekhnicheskiye raboty (Underwater engineering operations). Moscow, Transport, 1975, 277 pp. (RBL, 7-8/76, no. 1778)

Krivososov, I. I. Elektromekhanicheskiye izmeritel'nyye preobrazovateli davleniy vysotemperaturnykh sred (Electromechanical pressure transducers for high temperature media). Moskva, Energiya, 1975, 95 p. (LC)

Lazarev, A. I. Opticheskiye nablyudeniya s kosmicheskogo korablya "Voskhod-2" (Optical observations from the Voskhod-2 spacecraft). Leningrad, Gidrometeoizdat, 1975, 38 p. (LC)

Lazarev, L. P. Infrakrasnyye i svetovyye pribory samonavedeniya i navedeniya letatel'nykh apparatov. (Infrared and optical devices for automatic and guided control of aircraft). Third edition, revised. Moskva, Mashinostroyeniye, 1976, 566 p. (LC)

Mekhanizmy pererabotki informatsii v sensorynykh sistemakh (Information processing mechanisms in sensory systems). Leningrad, Nauka, 1975, 184 pp. (RBL, 7-8/76, no. 1823)

Nekotoryye voprosy sverkhprovodimosti (Trudy ordena Lenina fizicheskogo instituta im. P. N. Lebedeva, Tom 86) (Certain problems of superconductivity) (Transactions of the Order of Lenin Physics Institute im. P. N. Lebedev. Volume 86). Moscow, Nauka, 1975, 162 pp. (RBL, 7-8/76, no. 1241)

Reznikov, R. S., et al. Promyshlennyye poluprovodnikovyye detektory (Industrial semiconductor detectors.) Moscow, Atomizdat, 1975, 89 pp. (RBL, 7-8/76, no. 1903)

Sokolov, ed. Sbornik nauchnykh trudov po problemam mikroelektroniki. Khimiko-tekhnologicheskaya seriya (Collection of scientific papers on microelectronics. Chemical engineering series), no. 21, 1975, 232 p. (KL, 12/76, #9827).

Tekhnicheskiye sredstva morskoy radiosvyazi (Technical methods of marine radiocommunication) Trudy Tsentr. n-i in-t morsk. flota, no. 204. Leningrad, Transport, 1975, 128 p. (LC)

Ulomov, V. I., et al. Avtomatizatsiya sbora i obrabotki seysmologicheskoy informatsii (Automating the collection and processing of seismological data.) Tashkent, FAN, 1976, 118 pp. (RBL, 7-8/76, no. 2018)

Volkov, Yu. M., et al, eds. Optika i spektroskopiya (Optics and spectroscopy). Sbornik statey. Novosibirsk institut inzhenerov geodezii, aerofotos'yemki k kartografii Trudy, v. 36, 1975, 134 p. (KL, 12/76, #9673)

Vremennyye kharakteristiki lazernykh impul'sov i vzaimodeystviye lazernogo izlucheniya s veshchestvami. Sbornik statey (Time characteristics of laser pulses and the interaction of laser radiation with matter. Collection of articles). Trudy FIAN v. 84. Moskva, Nauka, 1975. (LC)

Source Identification

DAN SSSR	-	Akademiya nauk Belorusskoy SSR. Doklady
FiKhOM	-	Fiziko-khimicheskaya obrabotka materialov
GiA	-	Geomagnetizm i aeronomiya
IAN Az	-	Akademiya nauk Azerbaydzhanskoy SSR. Izvestiya. Seriya fiziko-tekhnicheskikh i matematicheskikh nauk
IVUZ Radioelektr	-	Izvestiya vysshikh uchebnykh zavedeniy. Radioelektronika
KL	-	Knizhnaya letopis'
LC	-	Library of Congress
Otkr izobr	-	Otkrytiya, izobreteniya, promyshlennyye obraztsy, tovarnyye znaki
RBL	-	Russian Book List
RZhF	-	Referativnyy zhurnal. Fizika
RZhKh	-	Referativnyy zhurnal. Khimiya
RZh Radiot	-	Referativnyy zhurnal. Radiotekhnika
VAN	-	Akademiya nauk SSSR. Vestnik